DOCUMENT RESUME

ED 218 008 PS 012 929

AUTHOR Ditchburn, Susan J.
TITLE Patterning Mathematical Understanding in Early Childhood.
PUB DATE 82
NOTE 10p.

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Concept Formation; Early Childhood Education; *Early Experience; *Learning Activities; *Mathematical Concepts; *Mathematics Instruction; *Young Children
IDENTIFIERS *Patterns in Arithmetic

ABSTRACT

Young children grow in an environment that is patterned in many different ways. These early experiences of pattern can be the basis for later understanding of the complex structures of mathematics. Teachers can structure experiences to encourage children to examine and analyze patterns, to discover symmetrical properties, to compare shapes and sizes in ordered sequences, to create patterns, to represent sequences visually and verbally, and finally to use numbers or letters to symbolize patterned series. Patterning is based on classification and seriation, processes which involve seeing both likeness and difference and which rule governed sequences with a starting point and a direction. Varied learning activities with patterns can be provided by teachers who consider visual, auditory, and motor learning modalities in conjunction with a cognitive hierarchy of learning tasks that progress from reproduction through identification, extension, creation, and translation. This schema, however, does not assist teachers in selecting activities which lead to basic mathematical understandings. The table included at the end of the paper lists activities learning modalities, and cognitive task hierarchies for specific learning experiences connected to specific mathematics concepts. Activities are appropriate for 4-, 5-, and 6-year-old children. (RH)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED218008

PATTERNING MATHEMATICAL UNDERSTANDING IN EARLY CHILDHOOD

Susan J. Ditchburn

Pattern abounds in the young child's early encounters with his environment. The telephone bell vibrates in a jarring sequence, vibrant fabric patterns assail his eyes, and repetitive sounds motivate the child to propel push toys across tessellated floor tiles. The young child is an active, constructive learner. Through his natural play activities the child acts on his world both mentally and physically constructing his own reality through a myriad of experience. Early learning is holistic; the child balances social, emotional, physical, and intellectual development: stacking tiles are carefully assembled as the child hones fine motor skills, glows with a sense of accomplishment, observes the sequence from large to small, and shares his achievement with his parents by describing the repeated pattern of colours as the beakers are interlocked. As parents and teachers seek to support the child's urge to know, initial experiences are provided which utilize perceptual encounters promoting a gradual development of the child's thought prior to a symbolization of his world in more abstract ways. The child stacks the beakers, makes a picture of his tower and uses language for verbal representation yellow, red, blue, green...and finally learns to recognize and predict the repeated pattern sequence. It is essential that as we plan instruction we consider approaches which support the child's natural striving towards understanding.

Early development, directed largely by the young child himself, is complex and rapid. Approaches chosen must stimulate physical and mental activity, reflect the child's background of real experience and recognize the current

PS 012929

GKW+5.1

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
☐ This document has been reproduced as received from the person or organization originating it.
X Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
Susan J. Ditchburn
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

developmental stage of the child. Patterning is one approach which incorporates these criteria in developing the foundation for mathematics learning. As mathematics is a patterned system, the child's earliest experiences may become a natural bridge to an understanding of the complex structure of mathematics. "The central purpose of any instruction in mathematics at the early childhood level is to help the child see order and meaning in the situations and events that occur in his day-to-day activities" - Payne (1978) p. 70.

Baratta-Lorton (1976) states that "Pattern is the underlying theme of mathematics. The skill of recognizing and using patterns is a valuable problem-solving tool for a child to learn to use, for it can have a profound effect on the development of the child's mathematical understanding" - p. 20. As we direct the young child's attention towards pattern we help him seek regularity and meaning in sequences. In this way the child moves towards making generalizations, forming hypotheses which may then be tested.

Patterning is basically a problem-solving approach. The child searches for a rule, makes a tenative hypothesis which is then tested. There is a movement from accidental encounters with patterns in the real world to those which are structured by teachers. Children are encouraged to examine and analyze patterns, to discover symmetrical properties, to compare shapes and size in ordered sequences, to create pattern, to represent sequences visually and verbally and finally to use numbers or letters to symbolize patterned series.

GKW+5.2

Patterning provides opportunities to reinforce ordinal position and to engage in reversible thought or mental undoing by returning to the starting point. Recent research on hemispheric functioning reinforces patterning as an appropriate approach to learning as the child uses both a logical, analytical, sequential approach while engaging in divergent, creative, imaginative activity. Patterning provides an outlet for affective development as children gain aesthetic satisfaction in design and use artistic, musical, and motor patterns.

The concept of patterning depends on classification and seriation. Children develop an understanding of relationships through seeing likeness and differences. Ordering denotes a rule governed sequence where there is a starting point and a direction. Both classification and seriation are necessary foundations for number. Patterning links these stages in a meaningful way and provides a conceptual arrangement which leads to the recognition of meaningful patterns throughout mathematics.

The dilemma, then, for teachers of young children is to design pattern activities wisely. A frame work, adapted from Burton (1982) is provided to guide selection.

	TASK HIERARCHY				
MODALITY	Reproduce	Identify	Extend	Create	Translate
Visual					
Auditory					
Motor					

GKW+5.3

Thus, patterns may be presented or represented visually (art, number, words or letters), auditorially (music, rhythm) or motorically (movement, dance). Activities may be structured to ensure that children experience pattern in a way that promotes increasing cognitive complexity. Reproduction involves observation, one-to-one correspondence, and seriation while identification demands classification and language use. As children extend patterns a problem-solving approach is used through developing a tentative rule to predict continued sequence. Children are encouraged to create a pattern in a variety of modes and finally to translate patterns from one mode to another.

While such a schema is useful in ensuring varied activities, both in terms of complexity and learning style, it does not assist teachers in selecting activities which ensure basic mathematical understandings. Thus an expanded framework must be considered. The approach taken by Gibb and Castaneda (1975) is helpful. Prenumber concepts preceed experiences with number as outlined below:

Prenumber Activities		Activities with Number
Classifying		Classifying
Comparing	NUMBER	Comparing
Ordering		Ordering
Measuring		Measuring
Organizing Data		Organizing Data
Shape and Size		Shape and Size
Seeing Patterns		Seeing Patterns

GKW+5.4

Thus, the activities which follow provide examples based upon Burton's (1982) classification of patterning activities and considering the strands of mathematics as provided by Gibb and Castaneda (1975). Activities have been limited to the prenumber stage. Each activity is presented through a real experience as suggested in the table. Activities are discussed in terms of the sensory mode employed by the child and the cognitive complexity as indicated by the hierarchy. Finally, the mathematical concept which is reinforced through the activity is listed.

Thus, for example, children may explore honeycomb, floor tiles and bricks leading to building with large blocks or attribute blocks. Children utilize a visual aproach to reproducing patterns as patterns seen in the environment are matched. Through this activity and through the language which accompanies it, children classify, "...we put the squares side by side..."; and develop concepts of shape and size;"...the small triangles go here..."

The table format is presented to assist with planning. A quick overview of plans organized in this way enables teachers to ensure that a balance of sequenced activities are provided.

Experience	Activity	Mode	Hierarchy	Math Concept
Honeycomb, Floor Tiles, Bricks	Attribute Blocks Block Building	Visual	Reproducing	Classifying Size and Shape Relationships
Three Dimensional Shapes	Pattern Blocks	Visual/ Motor	Reproducing/ Extending	Classifying/ Ordering

GKW+5.5

Two Dimensional Shapes	Collages, Border Patterns, Print Making, Geoboard	Visual	Reproducing/ Creating	Size and Shape Ordering
Design Cards	Bead Threading, Unifix Cubes, Pegboard Design, Parquetry Shapes Macaroni Threading	Visual/ Motor	Reproducing/ Extending/ Creating	Ordering
Fabrics	Print Making, Stitchery, Knitting	Visual/ Motor	Creating	Ordering/Size and Shape
Hoops and Canes	Pattern Sequence in Gym	Visual/ Motor	Reproducing/ Creating/ Translating	Ordering
Music	Claps, Taps Movements	Auditory	Reproducing/ Extending/ Creating	Ordering/ Organizing Data
Poetry	Clap Rhythm, Translate to Visual Form, e.g. (A, B, A, B)	Auditory	Reproducing/ Extending/ Creating	Ordering/ Organizing Data
Symmetry In Environment	Geoboard/Mirror, Art Blot Pictures, Vegetable Prints, Snow Flakes, Leaves	Visual	Reproducing/ Identifying	Shape & Size Comparing
Math Aids	Geoboard - Drop red bead on every 5th nail ....x....x ....x.... (Alternate with different numbers)	Visual/ Motor	Extending	Ordering - Number Patterns
Wall Paper Fabric	Match the Samples	Visual	Identifying	Classification

Fabric	Folded Paper - arrange precut two dimensional shapes in each square to create a pattern Vary pattern with rotations, slides, and flips	Visual	Creating	Ordering/ Shape & Size
Music	Tone bars - order from low to high, high to low	Auditory	Identifying	Ordering, Classification
Weaving	Berry Baskets, Onion Bags, Natural fibres and materials, yarn	Motor/ Visual	Creating	Measuring, Ordering (over-under)

Such activities will be useful for teachers working with four, five and six-year-old children. A number of approaches are suggested. An integrated unit or theme on patterns may be planned. Activities may be presented to children in large group teacher-directed situations or in small group learning centres. As patterning is a ubiquitous concept, children may experience patterning activities in many different thematic units occurring throughout the year. Teachers should consider the needs, interests and abilities of the children in selecting or developing pattern activities. Care should be taken to ensure that activities are sequenced to reflect the hierarchy suggested. Personal experience has shown that children have a natural delight in the patterns which abound in their environment. Thus, classroom activities, which utilize this natural delight to expose children to mathematical concepts, are received enthusiastically.

GKW+5.7

. . . Pattern plays a significant role throughout mathematics. Early work with patterning provides the framework for utilization of the many patterns found in mathematics: square and triangular numbers, number grids, commutative law, base ten system, multiplication and division of fractions and decimals, conversions in the metric system, to name but a few.

> "Searching for patterns within recorded data is an activity that is vital to economists, physical scientists, engineers, social scientists, doctors, businessmen, and many others.
>
> ...Searching for patterns is a worthwhile classroom activity for its own sake. It encourages children to bring mathematics under the power of their own intellects. It helps them gain independence and flexibility of mathematical thinking. It creates an alertness that makes the teaching of new topics faster and easier. Perhaps the excitement students experience from searching for patterns comes from the appeal to their imagination or from some inborn human desire to predict. At any rate, searching for patterns is a highly stimulating activity that ought to be practiced regularly in every mathematics classroom" Jencks and Peck (1968) p. 43.

GKW+5.8

BIBLIOGRAPHY

Baratta-Lorton, Mary. Mathematics Their Way, Phillippines: Addison-Wesley, 1976.

Burton, Grace M., "Patterning: Powerful Play". School Science and Mathematics, Vol. LXXXII (January, 1982), p.39-44.

Gibb, Glenadine and Castaneda, Alberta: "Experiences for Young Children". in Payne, Joseph N., ed. Mathematics Learning in Early Childhood. Thirty-seventh Yearbook of the National Council for Teachers of Mathematics. Reston, Virginia, 1975.

Jencks, Stanley M., and Peck, Donald M. Building Mental Imagery in Mathematics. New York: Holt Rinehart and Winston, 1968.

McKillip, William D., Patterns. Research and Development Centre in Educational Stimulation, University of Georgia, 1969.

Payne, Joseph N., ed. Mathematics Learning in Early Childhood. Thirty-seventh Yearbook of the National Council for Teachers of Mathematics. Reston, Virginia, 1975.

Sime, Mary. A Child's Eye View. London: Thames and Hudson, 1973.

Thornton, Carol A. "A Glance at the Power of Patterns". The Arithmetic Teacher, 1977, 24: 154-157.

Uhr, Leonard., ed. Pattern Recognition. New York: John Wiley and Sons, 1966.

William, E. M. & Shuard, Hiliary. Primary Mathematics Today. London: Longman, 1977.

GKW+5.9